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THE EFFECTS OF AGING UPON ORAL MUCOSA*

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The effects of aging upon skin have been considered in numerous reports (1–4), but the effects of aging on the oral mucous membrane have received comparatively little attention (5). Among the clinical aging changes of the oral mucosa are a loss of elasticity, a tendency to hyperkeratosis, and a delayed healing response (6). Microscopic features mentioned have been a thinning and atrophy of the surface epithelium, and degenerative changes in the underlying connective tissue (7, 8). In order to gain more definitive information concerning the effects of aging on human oral mucosa, a study was undertaken, following preliminary histologic observations on biopsy specimens of oral mucous membrane at various ages.

METHODS AND MATERIALS

Preliminary observations revealed that obvious differences could usually be detected between the oral mucosa of young and old patients. Between these two age groups, the mucosal pattern varied considerably.

One hundred biopsy specimens of oral mucosa were selected from patients ranging in age from six to sixteen (Group 1). Among the 100 specimens were examples of buccal mucosa, gingiva, hard palate, tongue, labial mucosa, and floor of the mouth. Another hundred specimens were selected from patients above the age of sixty (Group 2). Among these 100 specimens were examples of buccal mucosa, gingiva, hard palate, tongue, labial mucosa and floor of the mouth. A third group of 100 specimens represented ages 25–50. The specimens in these groups were selected from the extensive files of the Department of Oral Pathology. The tissue specimens were all taken within the past three years and represented normal or relatively normal oral mucosa (minimal chronic inflammatory infiltration). The specimens were selected, apart from age, only on the basis of the size of the tissue specimen. Sufficient size of the tissue block was necessary for the preparation of a number of adequate serial sections. Both sexes were represented.

All specimens had been fixed in 10% formalin and were stained with hematoxylin-eosin, periodic acid-Schiff technic for polysaccharides, alcian blue, and toluidine blue. The periodic acid-Schiff technic was controlled with diastase for the demonstration of glycogen.

Since the oral mucosa presents variations in the different areas of the mouth, comparisons between the two groups were made of tissues from similar areas. The majority of the specimens were of gingiva, palate and buccal mucosa.

HISTOLOGIC OBSERVATIONS

In general, the specimens of oral mucosa in both young and old groups presented consistent patterns.

Group I (Age 6–16)

In the young patients, the stratified squamous epithelium was characterized by well-formed cells with lightly staining cytoplasm. The intercellular spaces were not prominent. The stratum corneum presented slight to moderate degrees of parakeratosis. Buccal mucosa was usually not keratinized. Gingiva presented slight keratinization (Fig. 1) and palatal mucosa presented slight to moderate keratinization of the parakeratotic variety (Fig. 2). No hyperkeratosis was noted. The rete ridges were long and often extended deeply into the underlying corium (Figs. 1, 2).

The connective tissue of the corium consisted of dense collagen bundles with an obvious fibrillar pattern.

Group II (Age 60+)

In the older patients the surface epithelium was distinctly thinner in all areas of the mouth and the rete ridges were shorter and flattened. Gingival mucosa was lightly or moderately keratinized (Fig. 3). Palatal mucosa was keratinized and the keratinization was of the hyperkeratotic variety (Fig. 4). In many cases the palatal hyperkeratosis was notable, and the stratum granulosum was widened and prominent (Fig. 5).

The underlying connective tissue was composed of collagen bundles, often separated and tending to stain deeply basophilic (Fig. 4). In many sections the connective tissue appeared degenerate and fragmented (Fig. 5). In addition,

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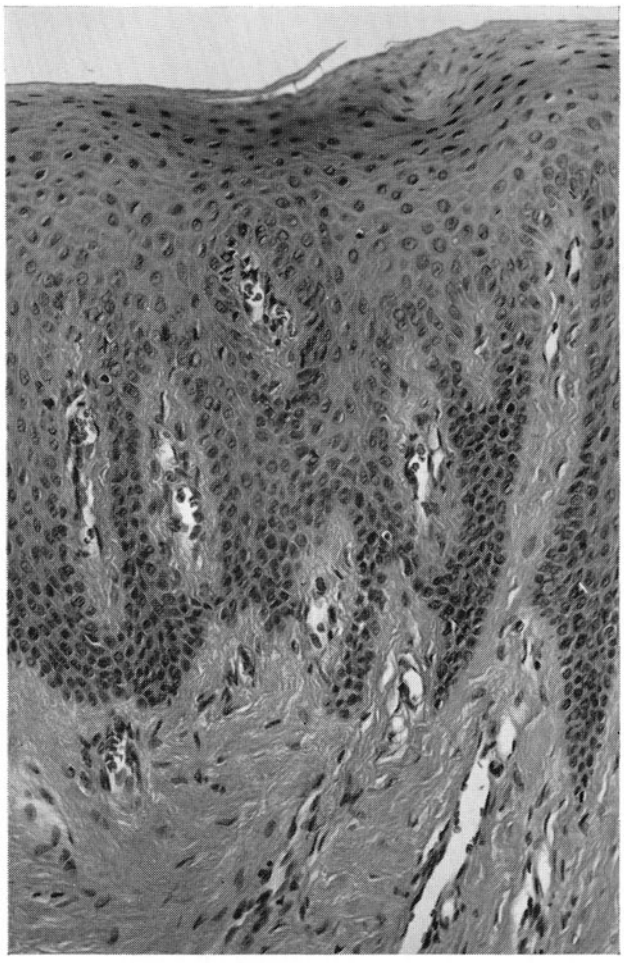

FIG. 1. Gingival tissue of 9 year old male. The epithelial surface is slightly keratinized. The cells are of even size and chromaticity. The rete pegs extend into the connective tissue which is dense and fibrillar. (Hematoxylin-eosin stain; × 66⅔.)

there were often areas of amorphous, homogeneous, hyaline-like material (Fig. 3). The most characteristic pattern was that of deeply basophilic and separated fiber bundles (Fig. 6, 7).

Group III (Ages 25–50)

No characteristic pattern was evident. The mucosa resembled that of Group I or Group II or presented a pattern intermediate between the first two groups.

HISTOCHEMICAL OBSERVATIONS

Group I (Age 6–16)

Periodic acid-Schiff stain revealed an absence of glycogen or polysaccharide in the epithelium. The basement membrane was strongly reactive and the connective tissue fibers moderately reactive. The basement membrane and connective tissue staining is not removed by diastase and may be considered to be mucopolysaccharide. (Fig. 8). Alcian Blue and Toluidine Blue staining further clarified the histologic observations.

Group II (Age 60+)

Periodic acid-Schiff stain revealed the presence of glycogen or polysaccharide in the epithelium. The glycogen was distributed in moderate amounts throughout the epithelium, but was absent in the stratum germinativum (Fig. 9). In some sections, the glycogen was sharply evident in the upper stratum spinosum and stratum corneum (Fig. 10). Alcian Blue staining of the tissues further clarified the histologic observations but presented no new differences between the mucosa of young and old patients. With the use of Toluidine Blue there appeared to be a definite increase in the number of mast cells in the oral mucosa of the older age group. In addition, the nuclei of the epithelial cells of the stratum germinativum appeared to stain more deeply in the older age group.

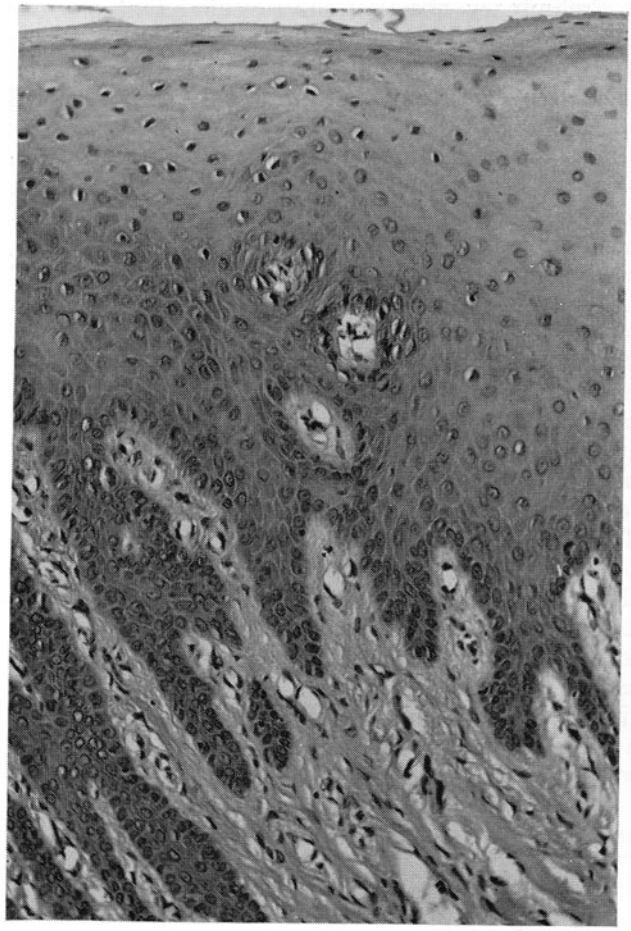

FIG. 2. Palatal mucosa of 13 year old female. The epithelial surface presents a zone of parakeratosis. The rete pegs extend deeply. (Hematoxylin-eosin stain; × 66⅔.)

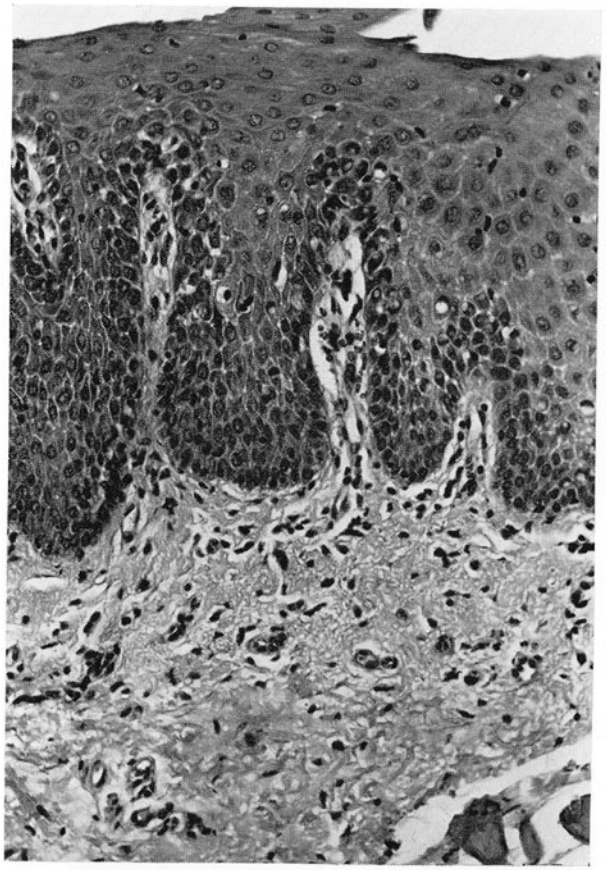

FIG. 3. Gingival tissue of 71 year old female. The epithelium stains deeply and many cells are pyknotic. The connective tissue is granular and degenerate with areas of hyaline-like material. (Hematoxylin-eosin stain; × 65.)

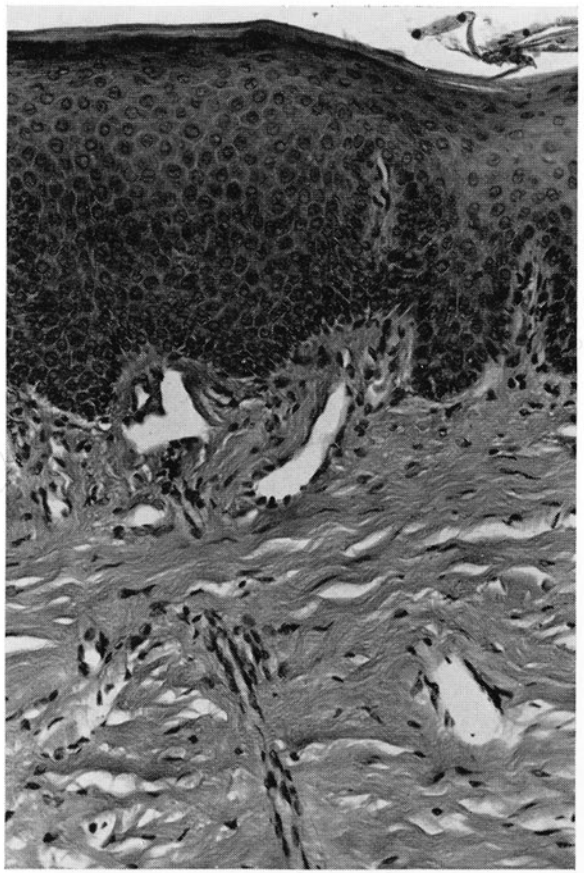

FIG. 4. Palatal mucosa of 68 year old male. The epithelium is thin and deeply staining. A distinct keratinization is evident at the surface. Rete pegs are short and blunted. The connective tissue is basophilic and the collagen bundles are separated. (Hematoxylin-eosin stain; × 66⅔.)

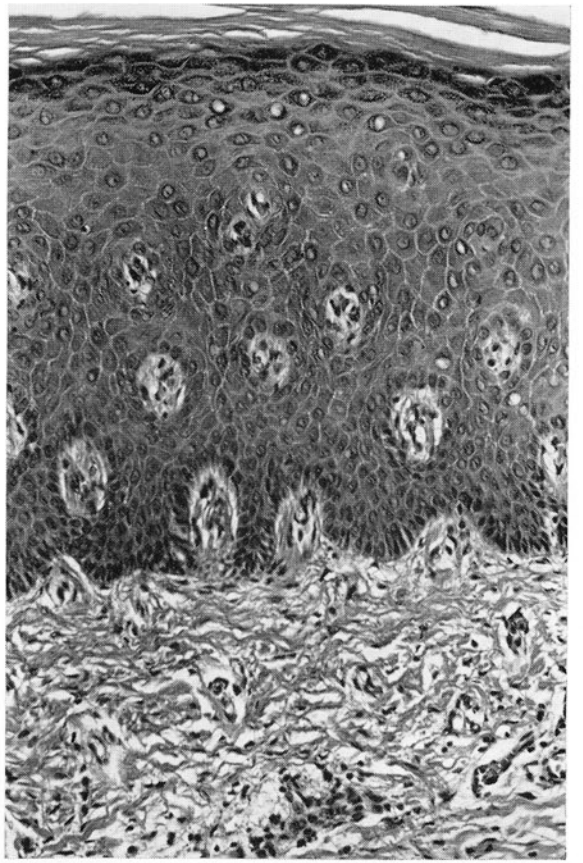

FIG. 5. Palatal mucosa in 63 year old male. The epithelium presents hyperkeratosis. The connective tissue presents atrophic, separated collagen bundles. (Hematoxylin-eosin stain; × 66⅔.)

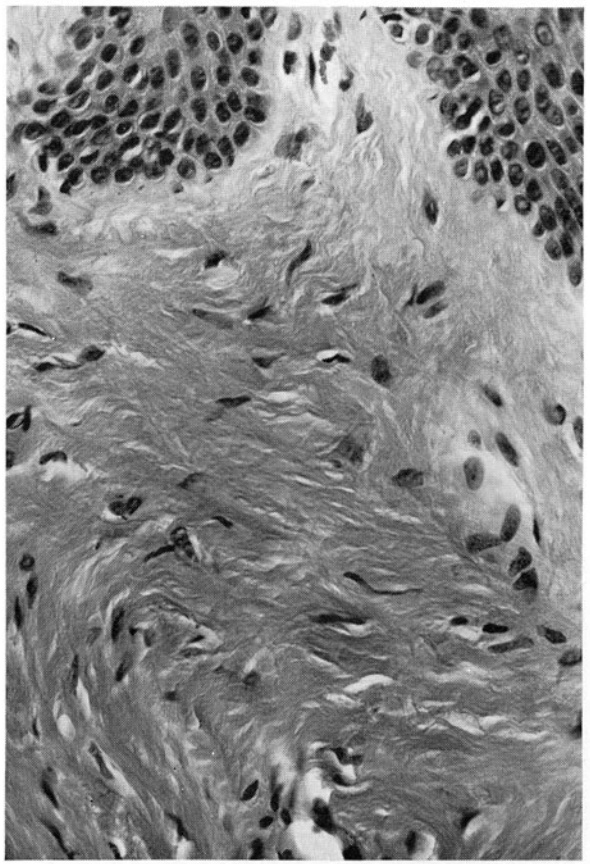

FIG. 6. Hight power magnification of Figure 1 showing the even distribution and finely fibrillar nature of the connective tissue. (Hematoxylin-eosin stain; × 166⅔.)

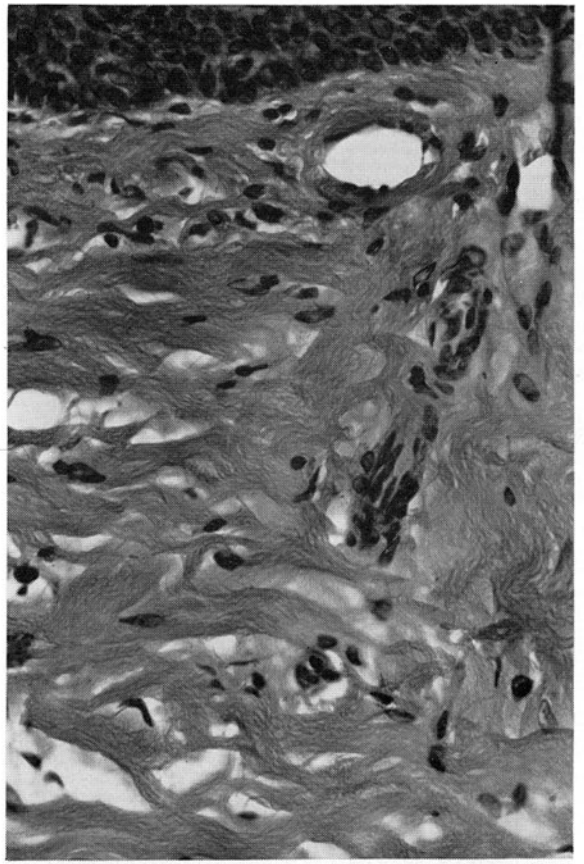

FIG. 7. High power magnification of Figure 4 showing the deeply staining, basophilic, coarsely fibrillar and separated collagen bundles in the connective tissue. (Hematoxylin-eosin stain; × 166⅔.)

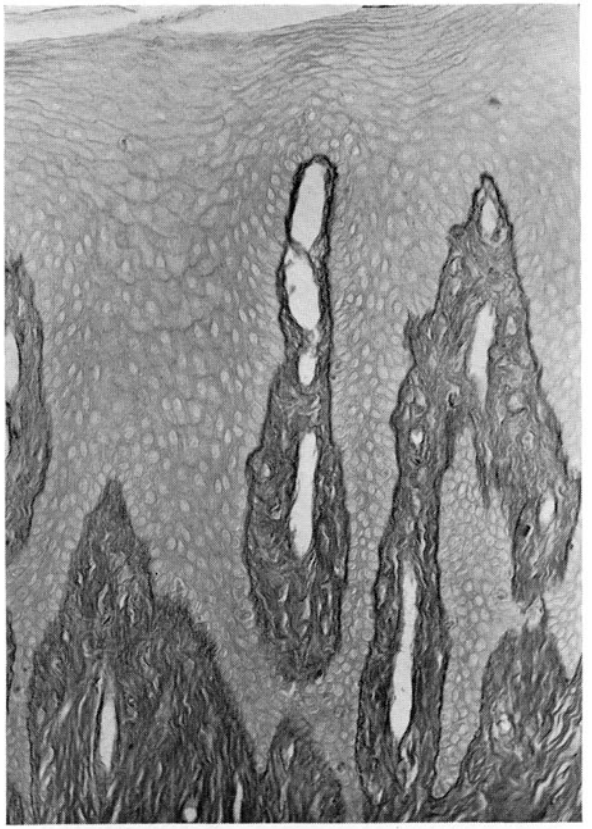

FIG. 8. Gingival mucosa in 8 year old male prepared for demonstration of glycogen and mucopolysaccharides. The epithelium is completely free of glycogen. The basement membrane and connective tissue stain for mucopolysaccharides. (Periodic-acid-Schiff technic; × 64.)

DISCUSSION

There appear to be distinct differences between the oral mucosa of young individuals and the oral mucosa of elderly persons. The patterns are sufficiently characteristic so that the patient's age group could usually be predicted from a study of the biopsy specimen. However, these sharp differences only occur in a comparison of the oral mucosa of the very young with the aged. In the intervening age group (ages 25–50) the tissue patterns vary considerably and may resemble that of either youth or old age, and may include features of both groups. It is of interest that the relatively sharp differences occur in the groups at the end of the age scale. Perhaps mucosal aging changes occur in the intervening age groups, but not be discernible by standard technics of tissue fixation and staining. Further histochemical studies may reveal gradual changes occurring throughout life.

The cause of the epithelial and connective tissue atrophy cannot be established, but a relationship to decreased vascularity may be postulated. A decreased production of steroid hormones (2), and decreased salivary secretion in old age (9) may also contribute to the changes noted.

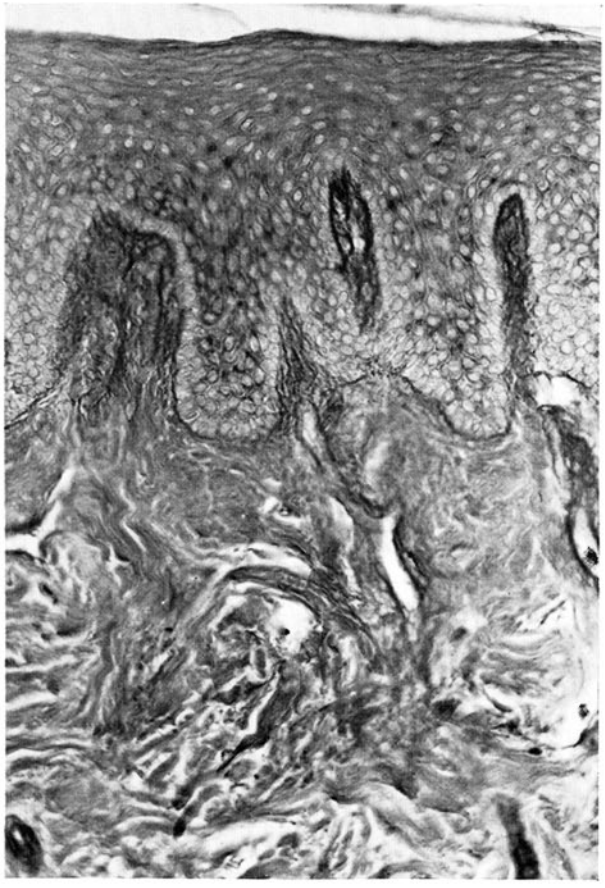

FIG. 9. Gingival mucosa in 62 year old male prepared for demonstration of glycogen and mucopolysaccharides. The epithelium contains a moderate amount of glycogen except in the stratum germinativum. (Periodic acid-Schiff technic; × 66⅔.)

FIG. 10. Palatal mucosa in 60 year old male prepared for demonstration of glycogen and mucopolysaccharides. The epithelium is reactive for glycogen in the upper stratum spinosum. (Periodic acid-Schiff technic; × 66⅔.)

The increase in polysaccharides within the epithelium appears to be another indication of the degenerative alterations of the mucosa. The increase in the number of mast cells in the mucosa of old age is an interesting observation, although the mast cells' usual histamine and heparin activity (10) in this connection is not apparent. There appeared to be no sex-related differences of the oral mucous membranes either in the hematoxylin-eosin sections or with the use of the histochemical stains.

REFERENCES

1. Cowdry, E. V.: Aging of the Integumentary System—*in* Conference on Problems of Aging. Edited by N. W. Schock. Josiah Macy Jr. Foundation, 1951.